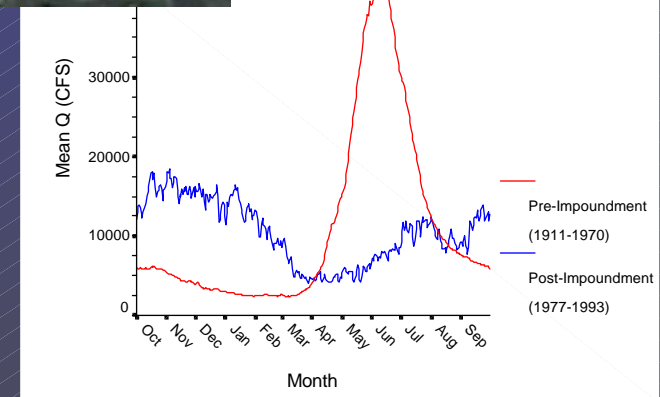
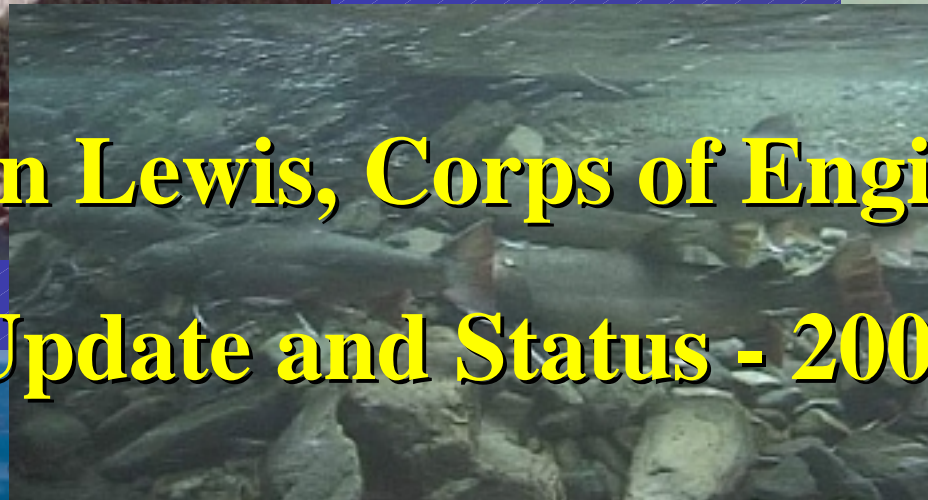
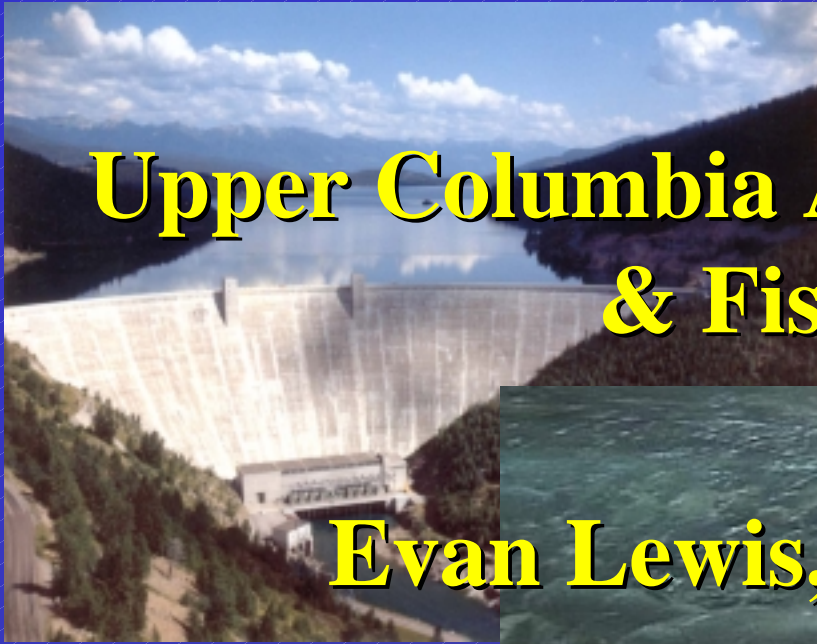


Upper Columbia Alternative Flood Control & Fish Operations

Evan Lewis, Corps of Engineers

Update and Status - 2003





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Presentation Outline

- Why consider changing dam operations?
- What is “*alternative flood control?*”
- What are “*fish operations?*”
- How do these operations work?
- Process
- Studies and analysis



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Endangered Species Act Requirements

- Operation of Federal dams adversely affects salmon, steelhead, sturgeon, and bull trout.
- A variety of actions are required to conserve and recover these threatened and endangered fish species.
- Requirements include changes in water management
 - Water storage (flood control)
 - Timing and flow rate of dam discharges (fish flows)



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Alternative Flood Control

VARQ = “Variable Discharge”

**Q is engineering shorthand for
“Discharge”**



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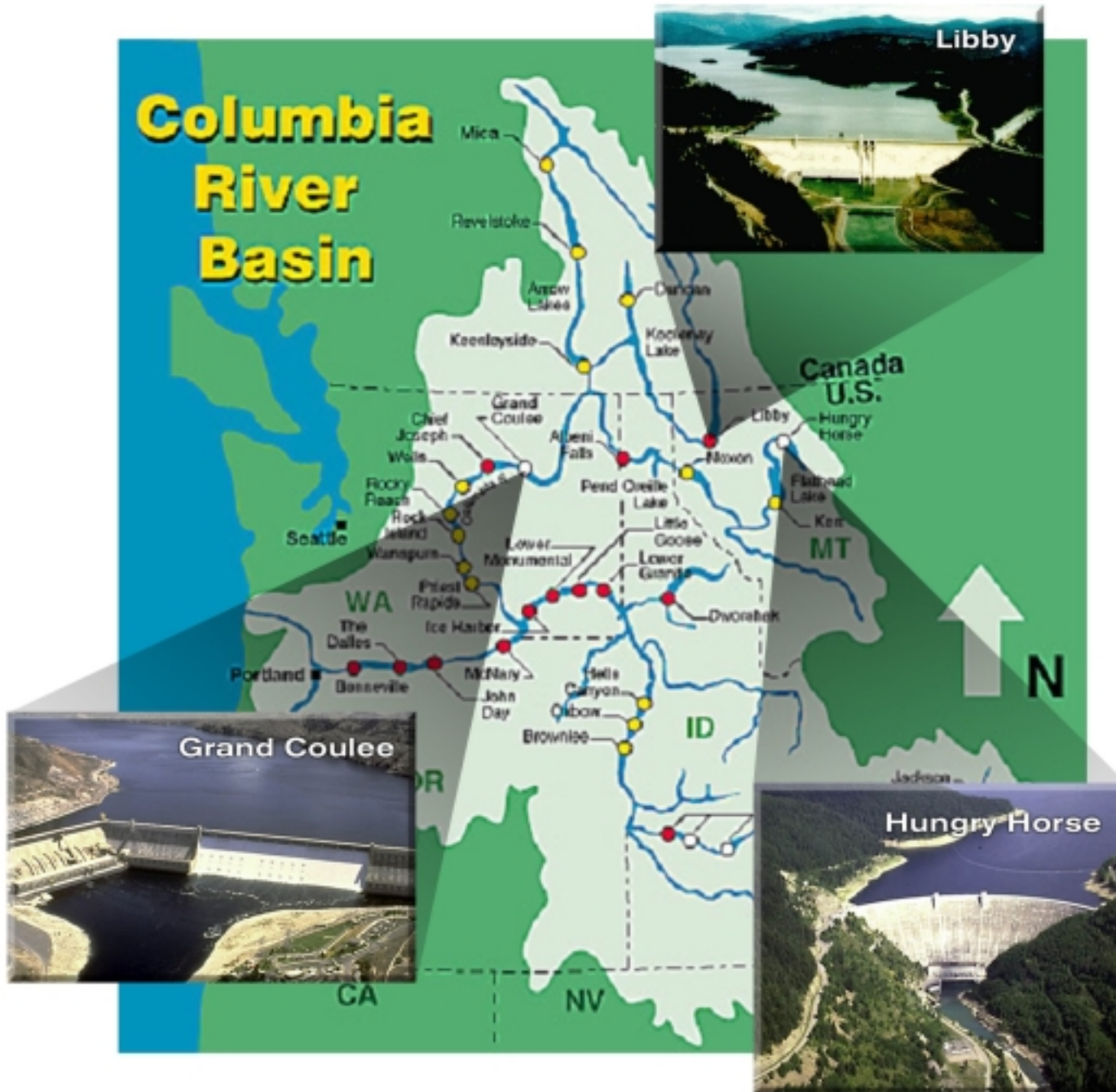
OBJECTIVES FOR VARQ

- Maintain effectiveness of existing flood control operation.
- Improve the multipurpose operation of the reservoirs and the Columbia River system.
- Improve probability of refill in light of fish flow releases for threatened and endangered species.
- Compared to baseline – pre-2003 flood control operation (standard flood control)



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Columbia River Basin





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VARQ Flood Control Operation at Libby & Hungry Horse

- VARQ requires less winter draft for below normal (60%) to above normal (125%) water supply forecasts.
- Variable outflows during reservoir refill in the spring (origin of VARQ name)
- VARQ outflows are tied to the water supply forecast.
- Requires the maximum flood control draft for above normal (>130%) water supply forecasts.



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Effects on Grand Coulee Operation

- Grand Coulee Dam: To compensate for reduced storage at headwater projects, may be drafted more deeply prior to start of refill (April/May).
 - Based on how much flood control upstream of Grand Coulee and water supply forecast.
 - Using existing process to determine flood control draft targets.
 - Within historical operating range.



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Why VARQ ?

- **Part of “reasonable and prudent alternatives” to comply with Sections 7 and 9 of the Endangered Species Act:**
 - **As detailed in the U.S. Fish and Wildlife Service and National Marine Fisheries Service (NOAA Fisheries) Biological Opinions of December 2000 concerning operation of the Federal Columbia River Power System**



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VARQ – Evacuation Side

Drawdown (Draft)



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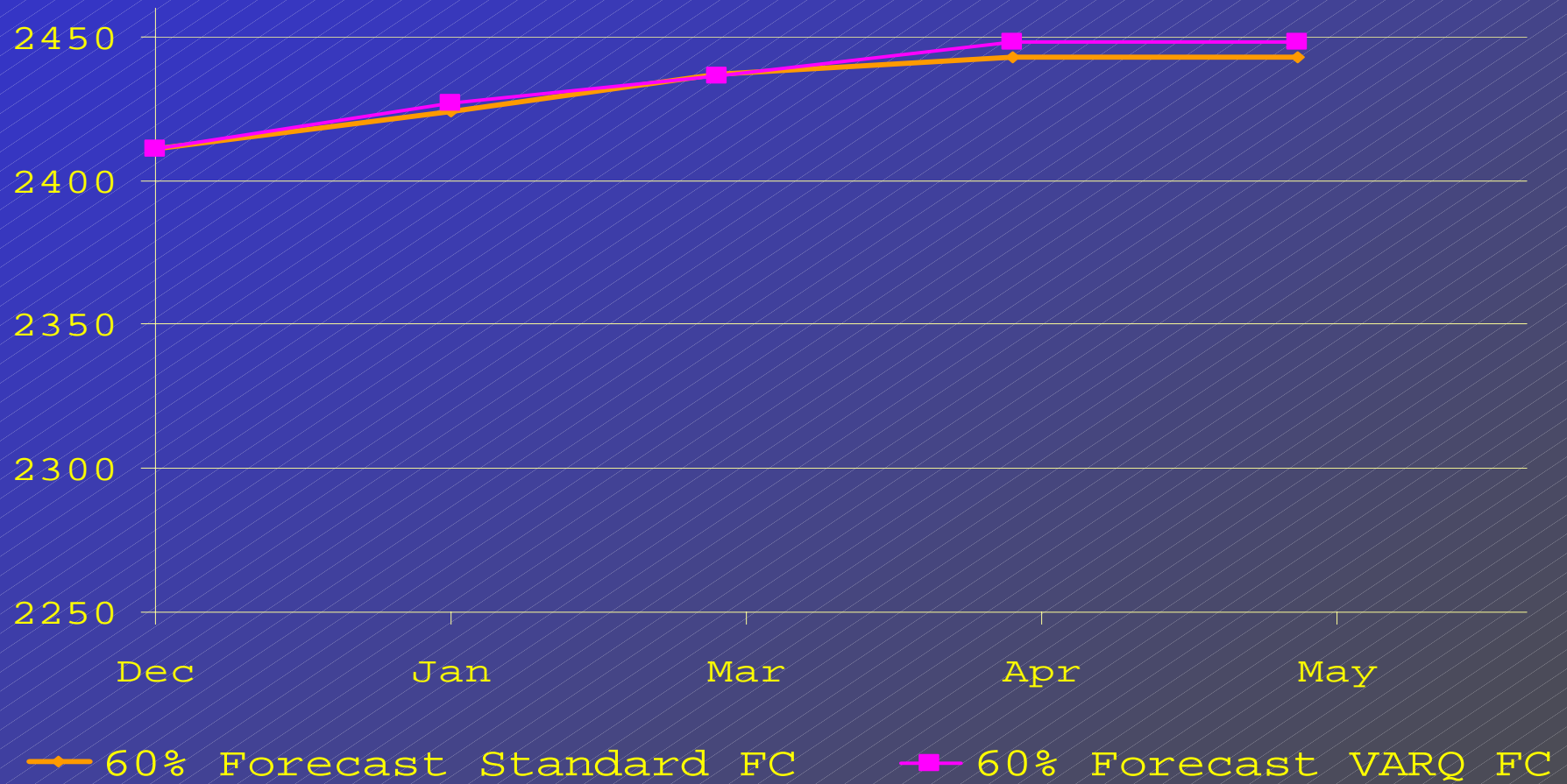
Flood Control Draft

- Reservoir evacuation requirements for flood control season are based on monthly forecasts for seasonal water supply (based on storage reservation diagram).
- In years with water supply forecasts between 60% to ~125% of average, VARQ end-of-month target elevations for reservoir are higher than those for standard flood control.



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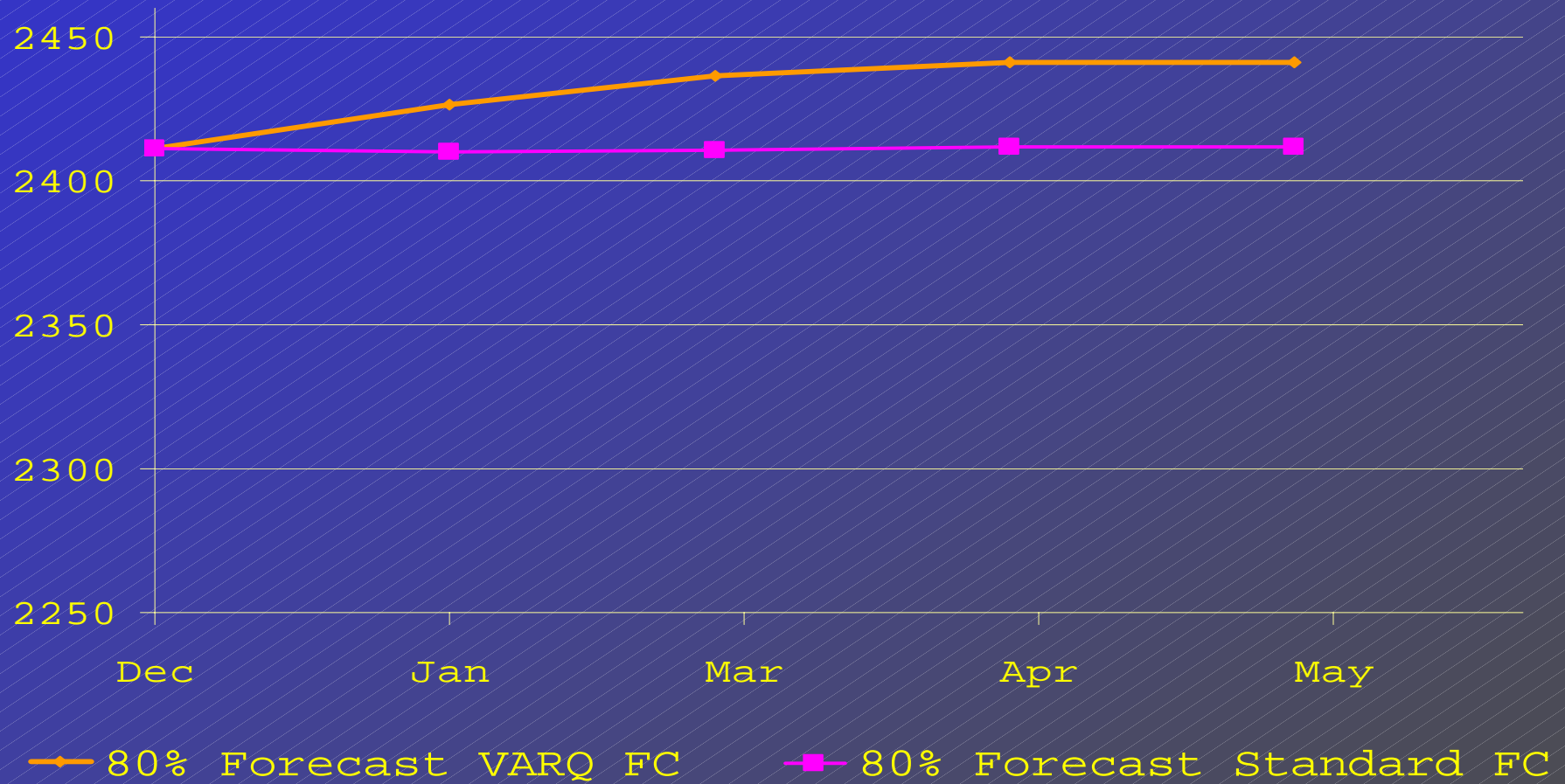
LIBBY - 60% WATER SUPPLY FORECAST





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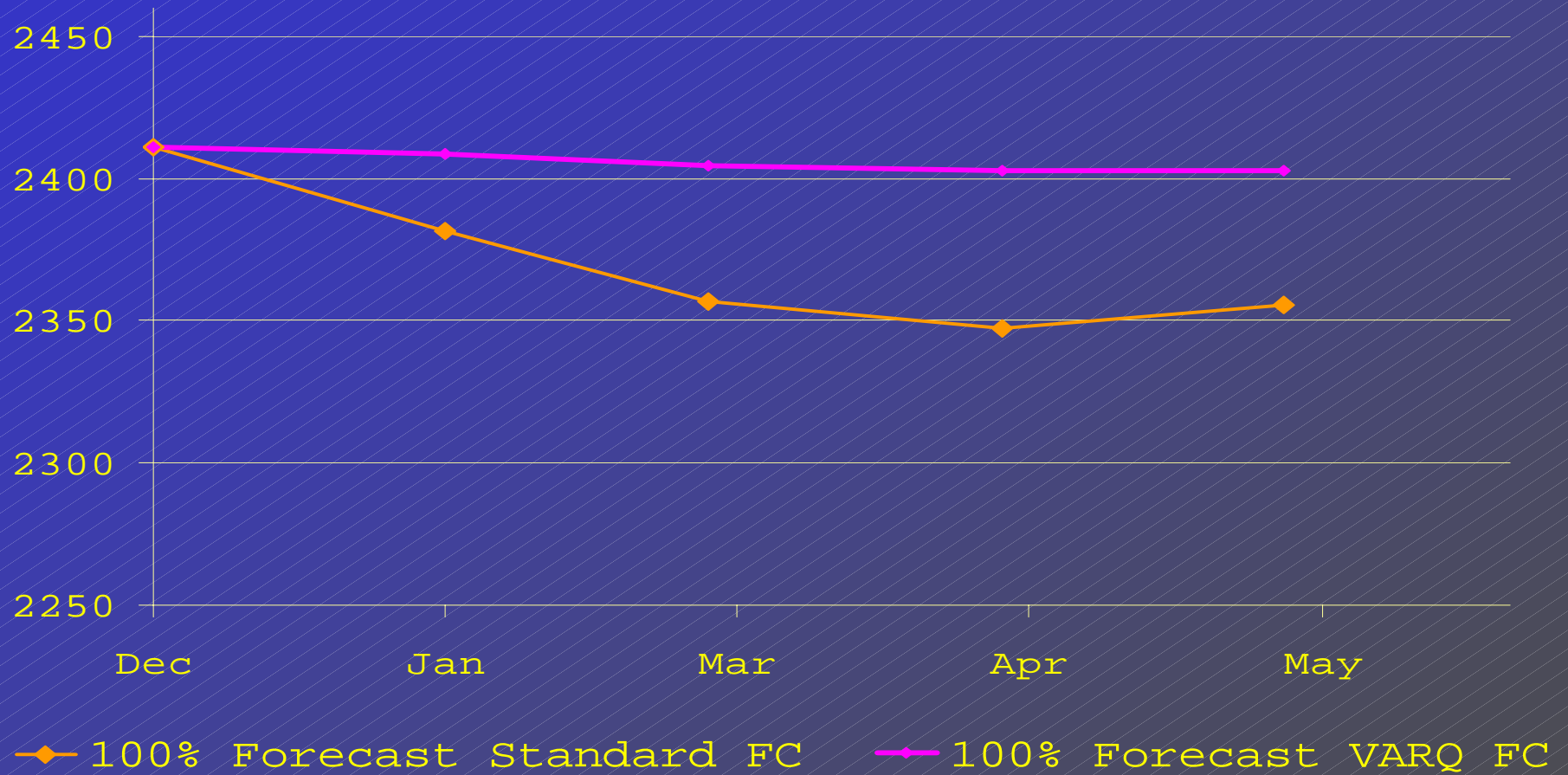
LIBBY - 80% WATER SUPPLY FORECAST





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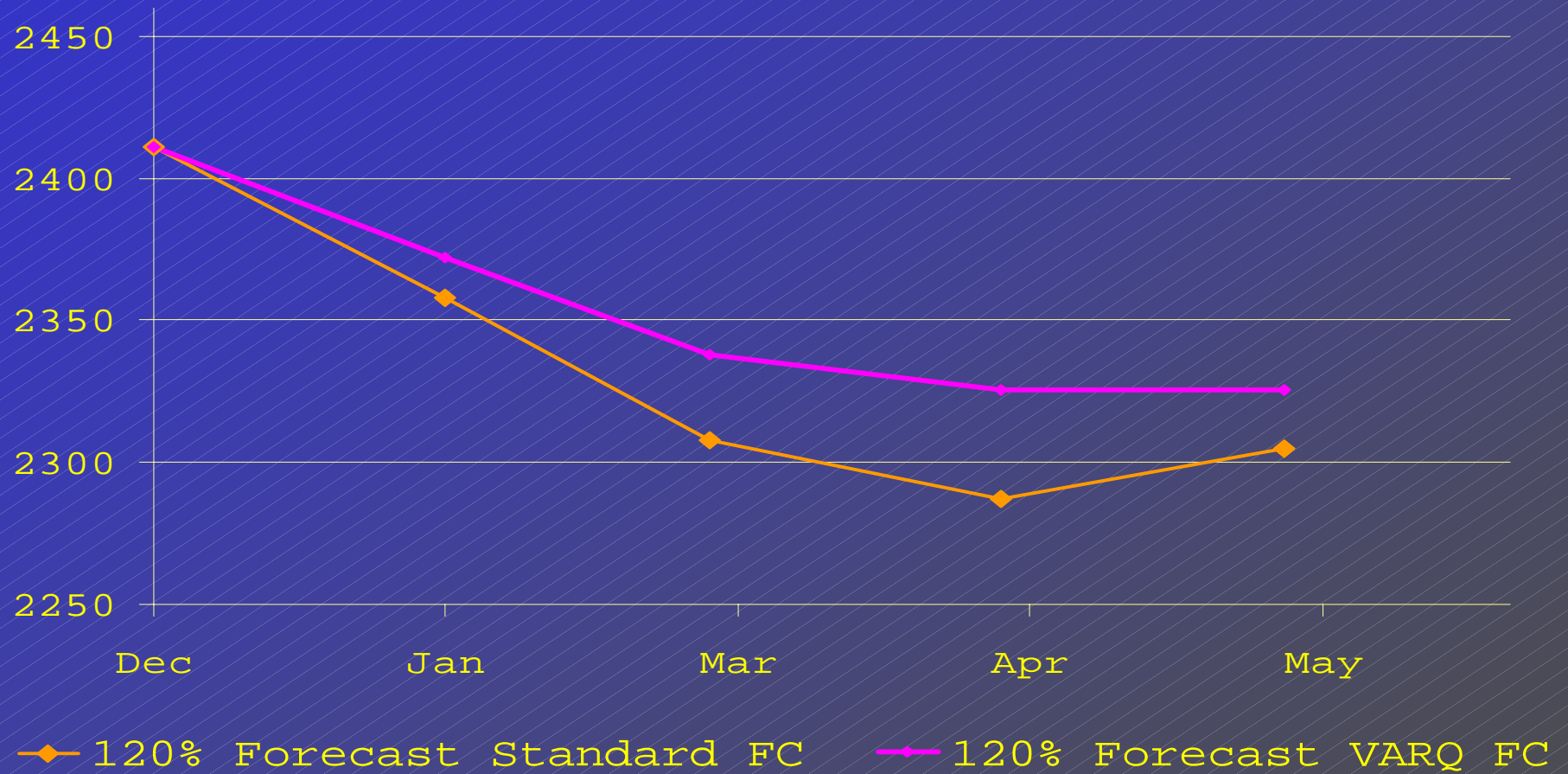
LIBBY - 100% WATER SUPPLY FORECAST





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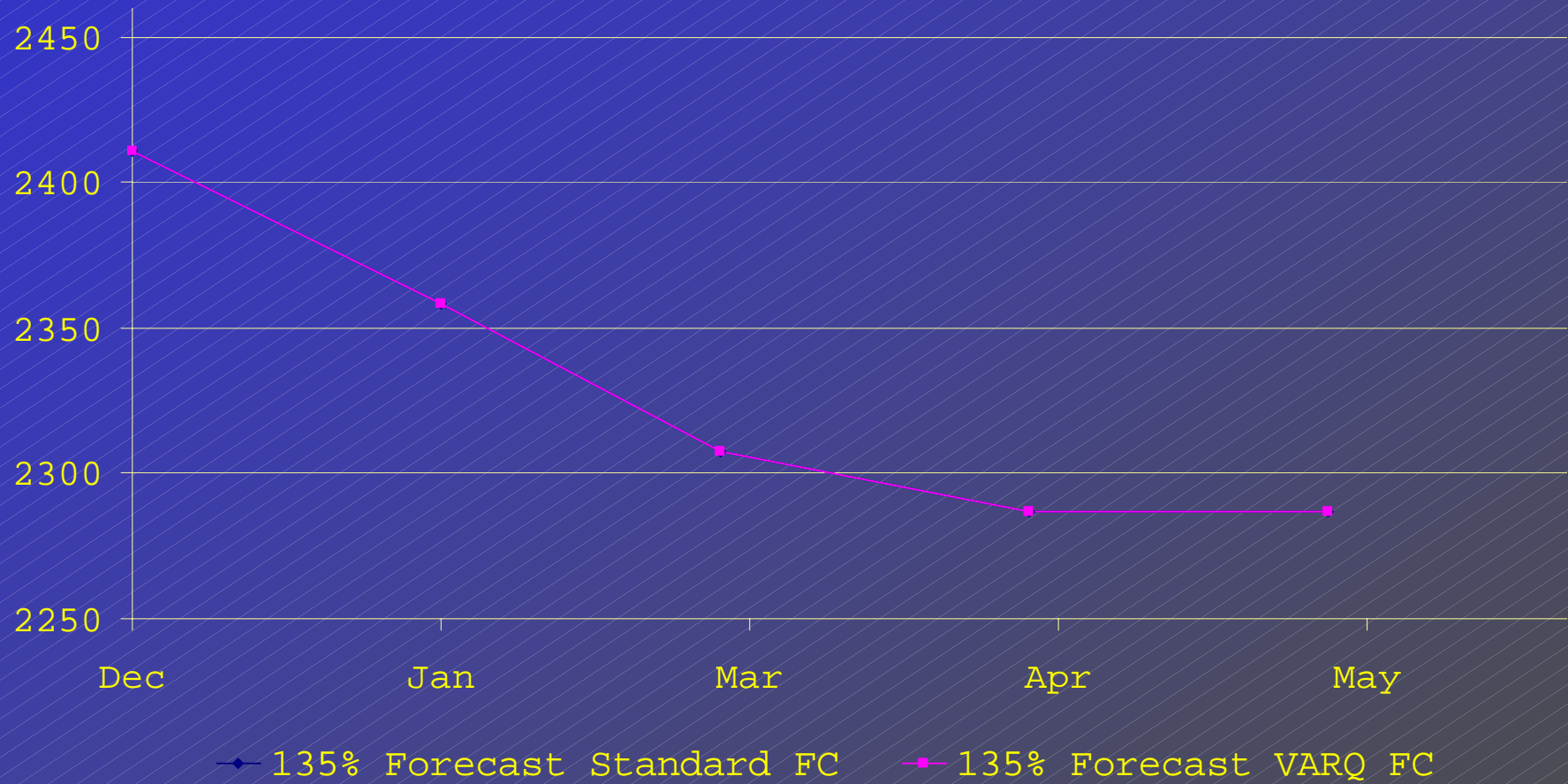
LIBBY - 120% WATER SUPPLY FORECAST





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135% WATER SUPPLY FORECAST





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Flood Control Draft

- In practice, reservoir elevations likely different in years with ~80% to ~120% of average seasonal water supply.
 - Low water supply years, reservoir levels not as high as flood control target elevation.
 - High water supply years, “trapped storage” tends to drive reservoir elevations higher than flood control target elevation.



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2003 VARQ Operations at Libby

<u>Water Supply Forecast</u>			<i>Target Elevations</i>		<i>Actual</i>
			<i>VARQ</i>	<i>Standard</i>	<i>Elev.</i>
JAN	4.86	(77.8%)	2426.7	2413.8	2408.4
FEB	4.66	(74.6%)	2436.4	2423.2	2405.7
MAR	4.18	(66.9%)	2444.9	2437.0	2404.3
APR	4.96	(79.3%)	2449.8	2416.6	2411.5



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VARQ – Refill Side



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VARQ FC @ Refill Side

- For Standard FC, outflows during refill are always held steady at the minimum flow level (4,000 cfs @ Libby).
- VARQ FC is designed around the concept of allowing outflows to vary during refill based on the water supply forecast beginning on 1 May.



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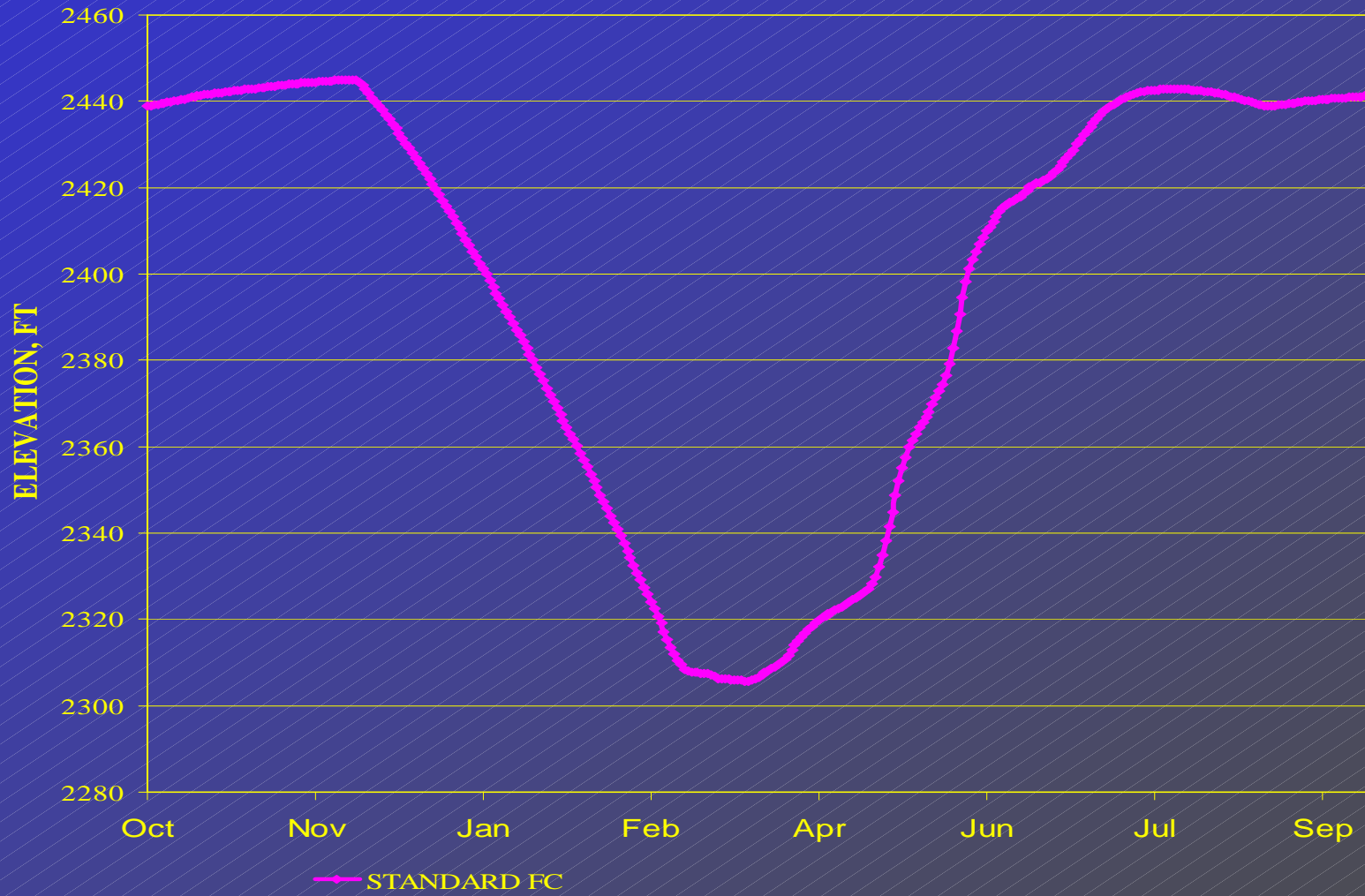
VARQ FC @ Refill Side

- During refill at Libby, minimum average VARQ outflows can vary from 5,000 cfs to 25,000 cfs depending on changing forecast,
 - Results in a slower rising reservoir level.
- For VARQ FC during local downstream flooding, project releases are held to normal minimum flow.



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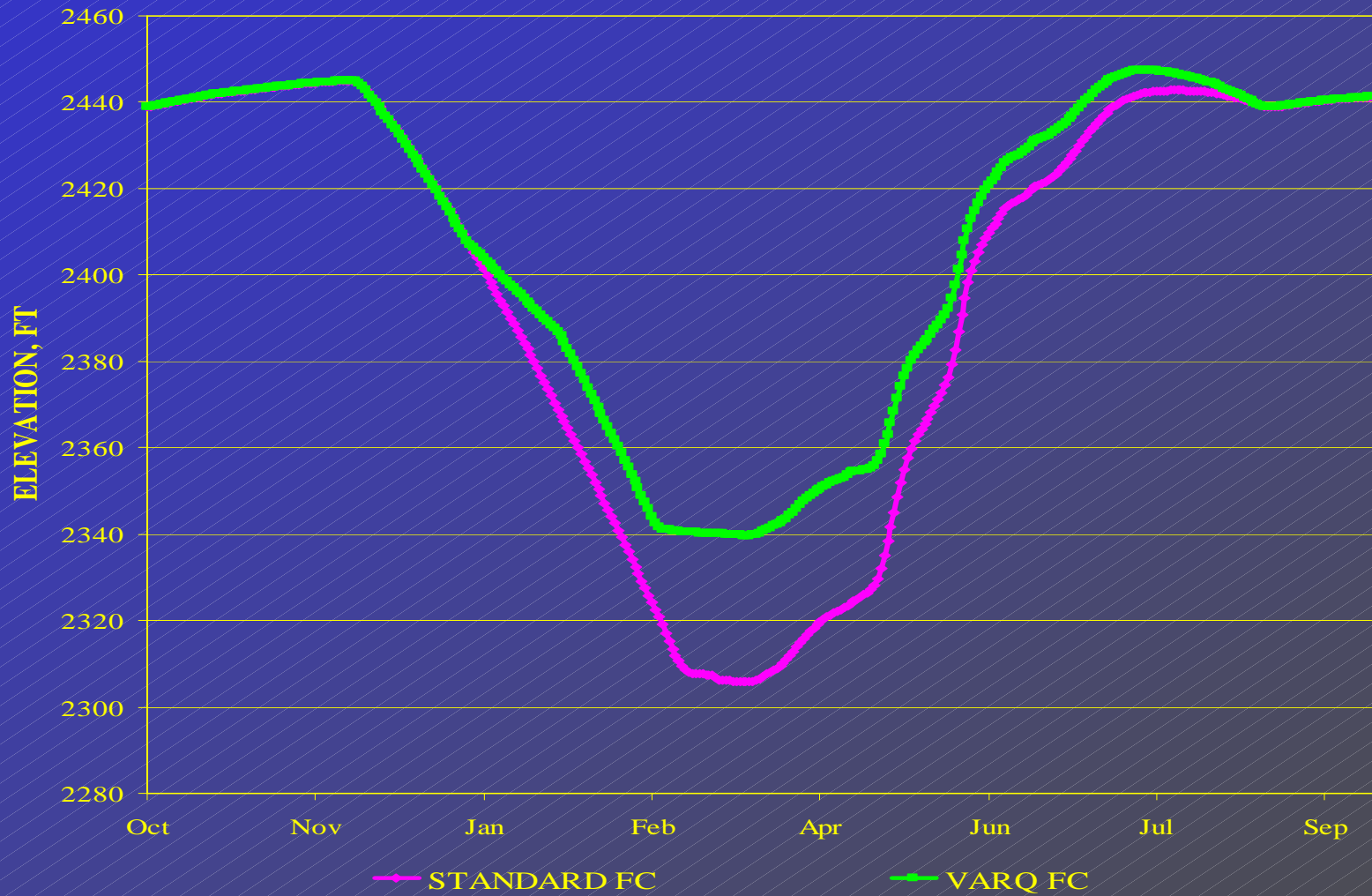
LIBBY SIMULATED ELEVATION, 1966





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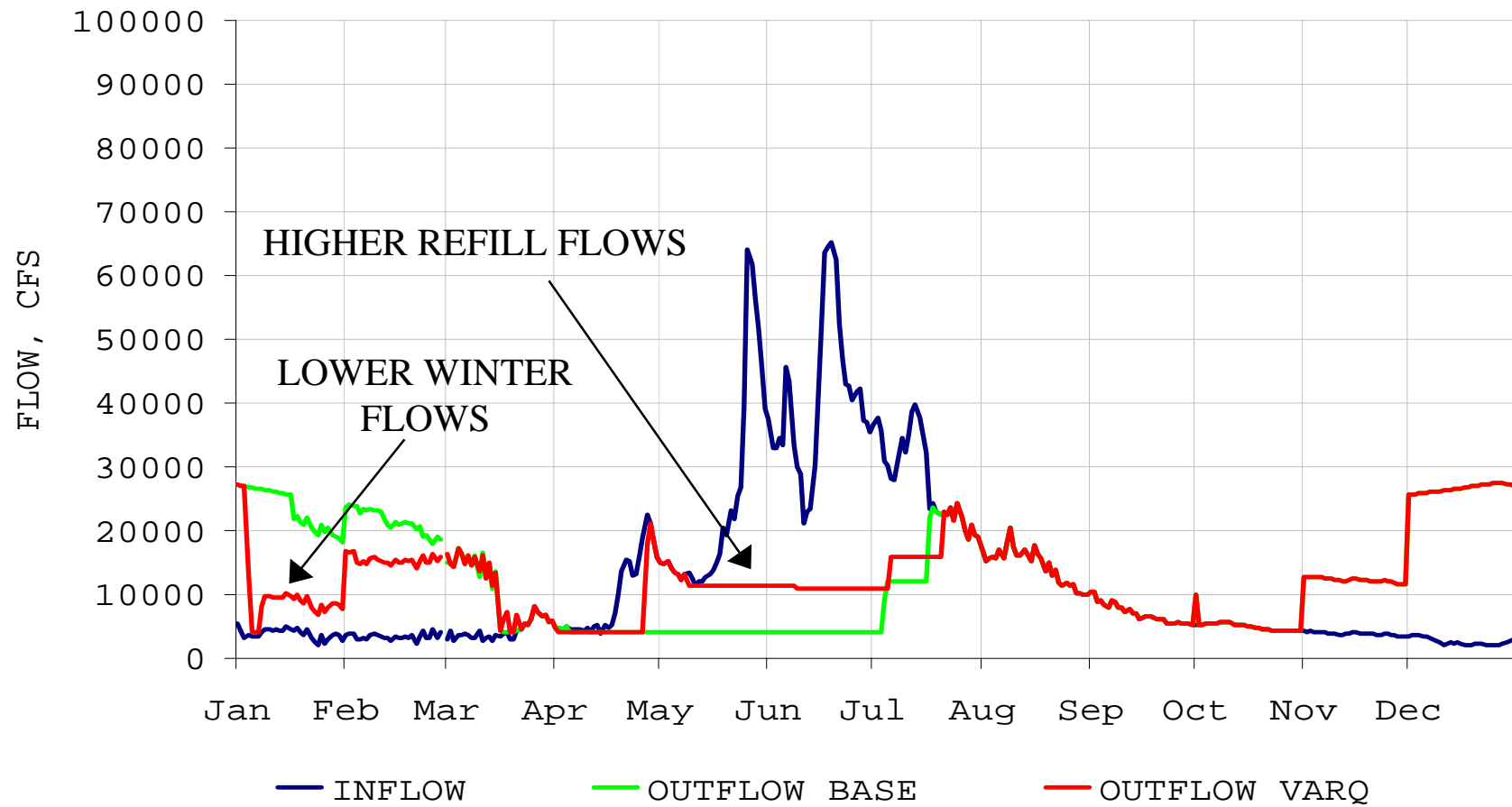
LIBBY SIMULATED ELEVATION, 1966





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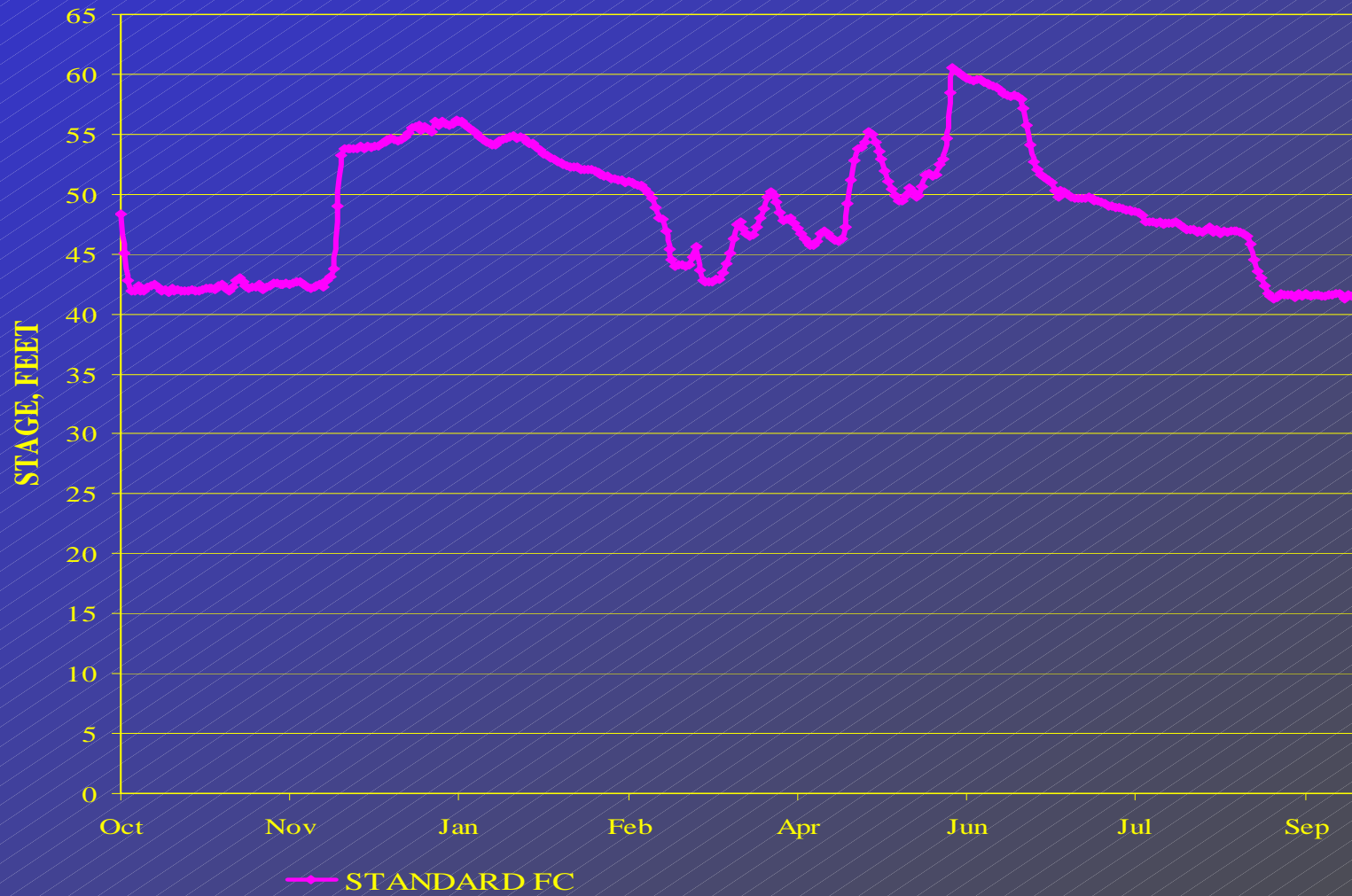
LIBBY OUTFLOW STANDARD FC VERSUS VARQ FC





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SIMULATED BONNERS FERRY STAGE, 1966





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SIMULATED BONNERS FERRY STAGE, 1966

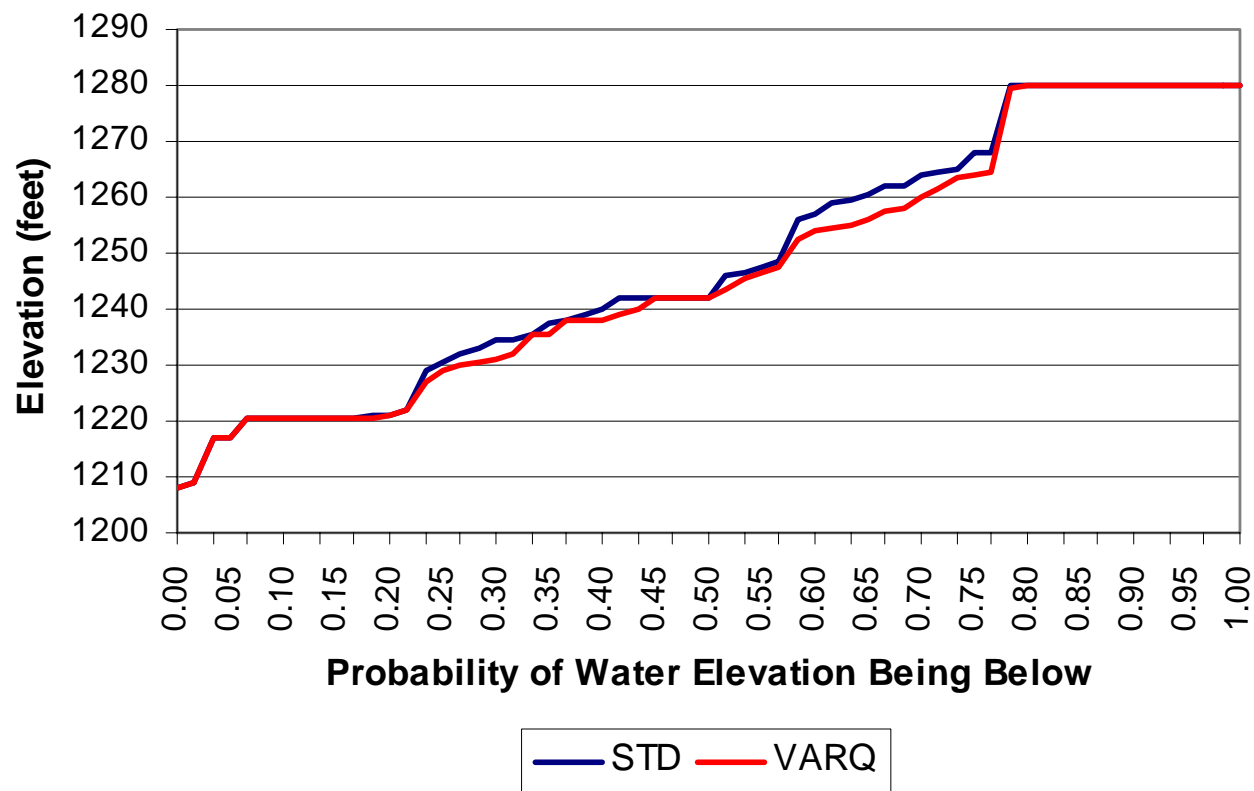




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Effects on Grand Coulee

End of April Elevation-Frequency Curves at Grand Coulee - Standard and VARQ FC.

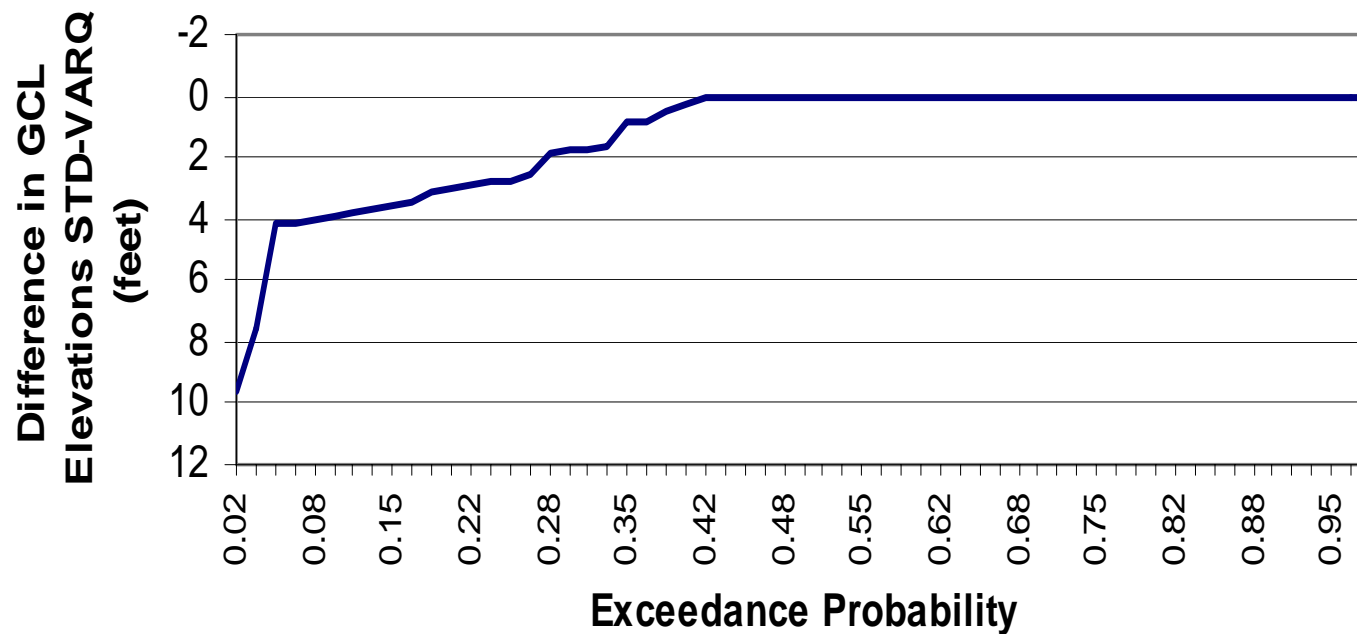




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Effects on Grand Coulee

April Probability of Exceedence STD-VARQ GCL Elevation
Differences





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Fish Operations

GOAL: To provide flow conditions for threatened and endangered resident and anadromous fish species.

- Kootenai River white sturgeon.
- Columbia Basin bull trout.
- Columbia River salmon and steelhead



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Fish Operations (cont.)

- VARQ is an alternative flood control operation that stores more water behind the dam.
- Fish operations specify how that stored water is released for benefit of various fish species.
- Fish flows required regardless of flood control operation.
 - Provided since early 1990's at Libby, since late 1990's at Hungry Horse.
 - VARQ implemented at Hungry Horse in 2002, Libby in 2003

Libby's "Fish Flow Tiers"

for White Sturgeon and Bull Trout (from 2000 U.S. Fish & Wildlife Biological Opinion)

Forecast Runoff Volume (maf) at Libby	Sturgeon Flow Volume (maf) from Libby Dam	Min. Bull Trout Flows between Sturgeon and Salmon Flows
0 < forecast < 4.8	No sturgeon flows	6 kcfs
4.8 < forecast < 6.0	0.8	7 kcfs
6.0 < forecast < 6.7	1.12	8 kcfs
6.7 < forecast < 8.1	1.20	9 kcfs
8.1 < forecast < 8.9	1.20	9 kcfs
8.9 < forecast	1.60	9 kcfs

maf = million acre-feet

kcfs = 1000 cubic feet per second



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Sturgeon Flows at Libby

- Shape, timing, and duration of discharge requested each year by USFWS.
- Up to maximum Libby discharge capacity.
 - Currently, powerhouse capacity + 1 kcfs spill (26 and 28.5 kcfs depending on pool elevation).
 - Working with Montana to potentially increase spillway flows for 2004.
 - BiOp calls for powerhouse + 10 kcfs capacity by 2007.
 - Concerns about TDG are primary.



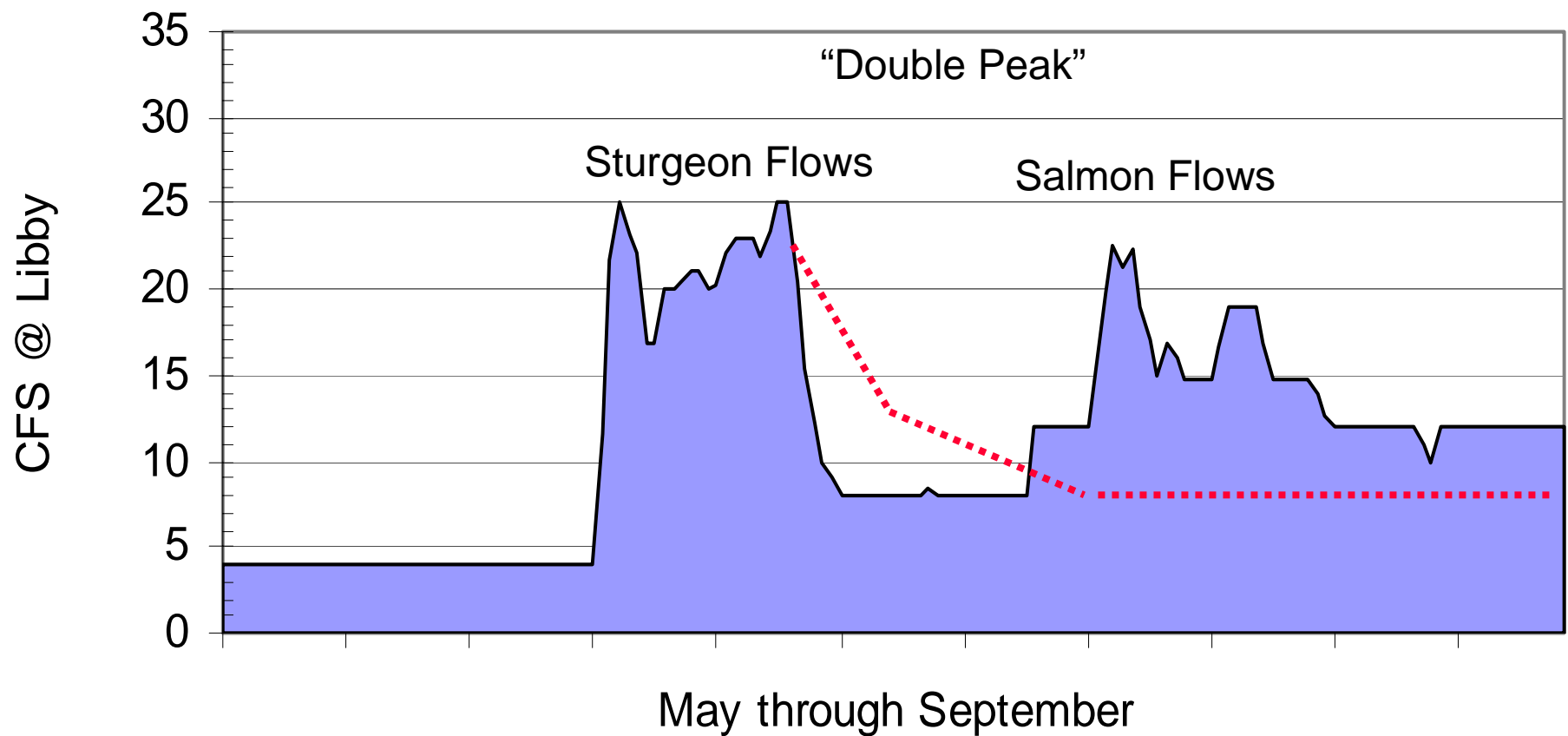
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Summer Salmon Augmentation

- At both Libby and Hungry Horse, refill by end of June/early July, then draft to be 20-feet below full pool by August 31.
- Attempt to reduce “double peak” with in-season management.
- At Libby, can result in flows >15 kcfs through summer to reach end-of-August target.

Managing the “Double Peak”

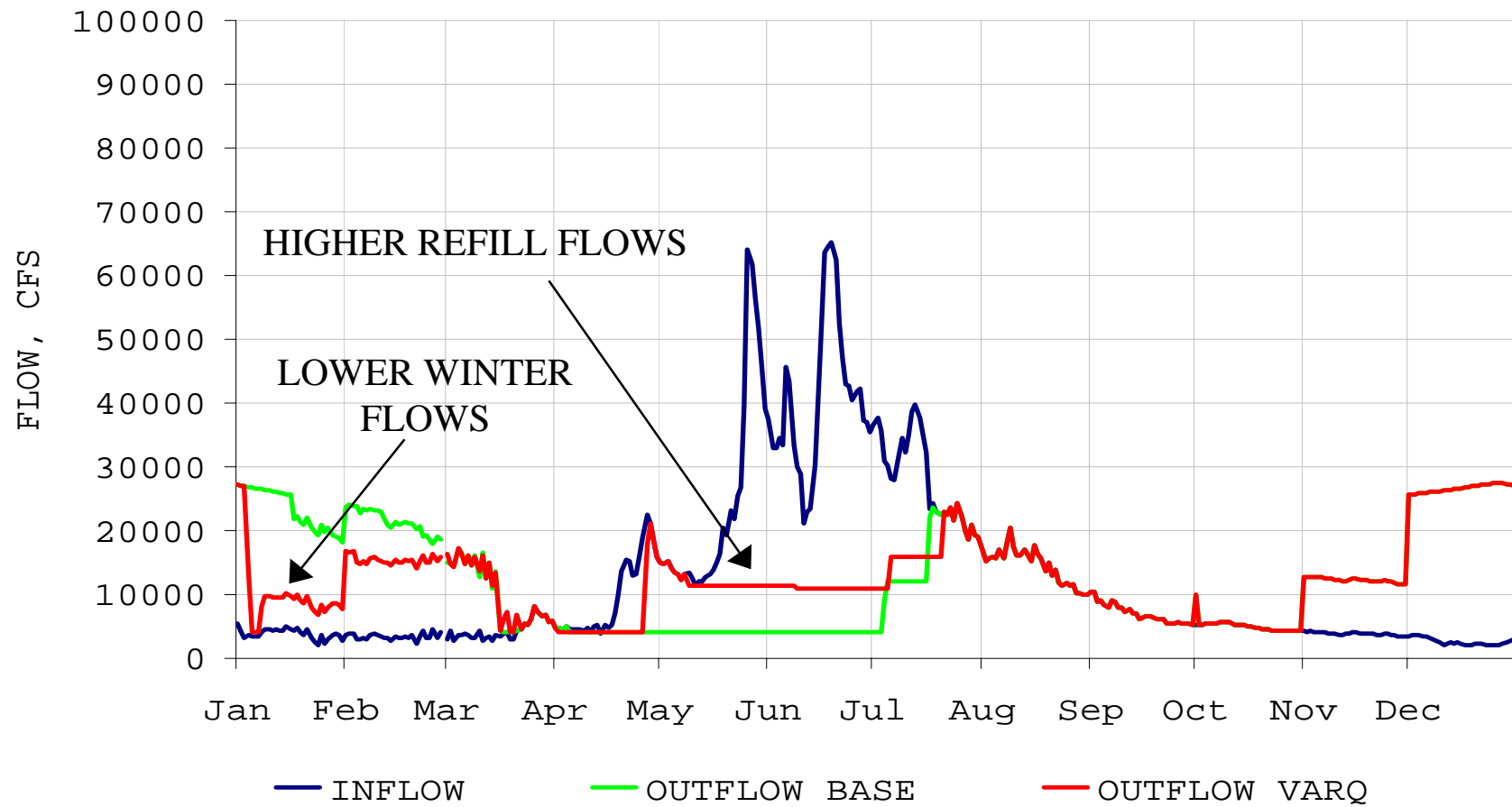
1999 Kootenai River Summer Flows





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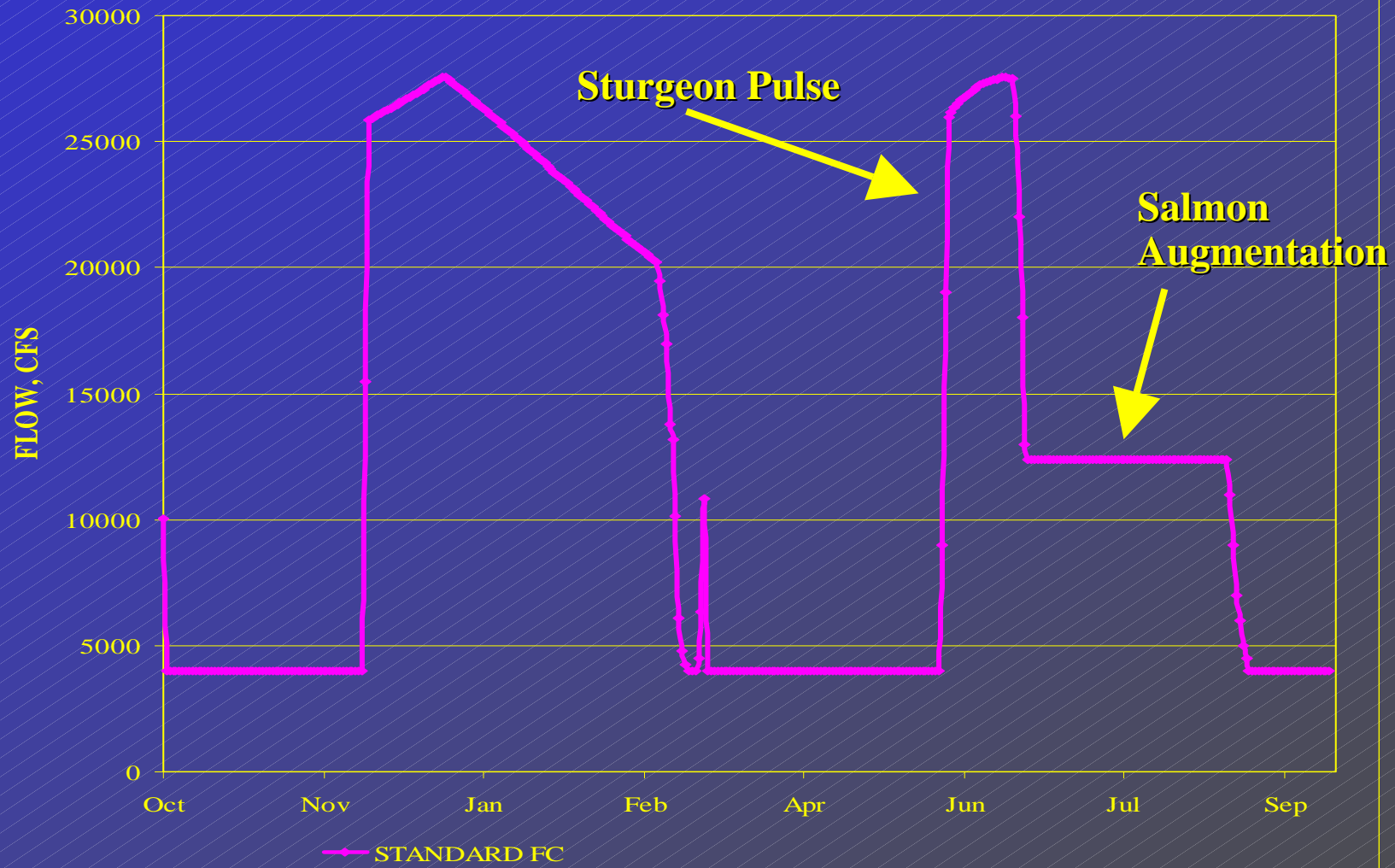
LIBBY OUTFLOW STANDARD FC VERSUS VARQ FC





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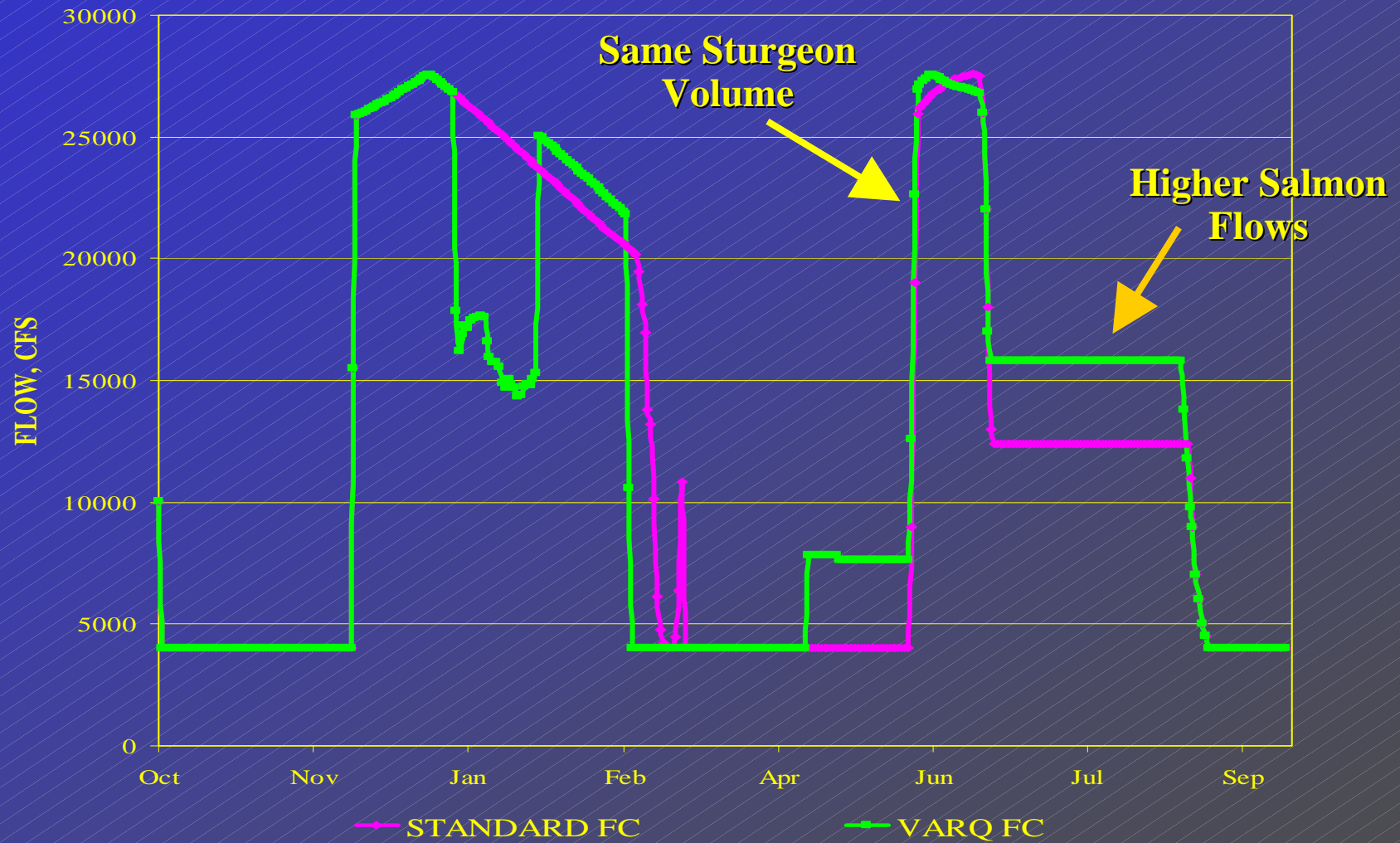
LIBBY SIMULATED OUTFLOW, 1966





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LIBBY SIMULATED OUTFLOW, 1966



**Notice of Intent to Prepare an
Environmental Impact Statement**

1 October 2001

EIS Scoping Meetings

October 2001-January 2002

**Interim VARQ Implementation at
Hungry Horse**

March 2002

Final Scoping Document

April 2002

Timeline and Schedule

**Interim VARQ Implementation at
Libby**

December 2002

**Draft EIS by fall 2004; Final
EIS completed by mid-2005**

**Implementation of a preferred alternative
would occur in 2006 water year**



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Interim Decision Process

- BiOps call for VARQ implementation by 2002 water year.
- EIS process not complete prior to 2006 water year.
- Failure to implement VARQ at Libby and Hungry Horse prior to 2006 may result in unanticipated take of listed species.



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Interim Decision Process

- Sufficient information available to evaluate impacts of interim VARQ implementation in time for 2003 water year.
- Environmental assessment detailed the impacts of interim implementation for several years prior to EIS.



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Interim Decision Process

FINDINGS FOR INTERIM VARQ IMPLEMENTATION

- ✓ Short duration of decision prior to completion of EIS.
- ✓ Benefits to sturgeon, bull trout, salmon, burbot.
- ✓ Modeling indicates a small increase in flood risks along Kootenai River, but not a significant increase when real-time water management is considered.
- ✓ Economic impacts to agricultural community, but economic effects alone not sufficient under NEPA to delay interim implementation.
- ✓ Action is reversible if additional information becomes available to warrant re-consideration.



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EIS Process

- Will address impacts of long-term implementation of alternative flood control and fish flow operations
- Will incorporate most up-to-date information and study results
- Update and supplement to analysis of interim implementation



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E.I.S. Goals

Disclose potential environmental impacts of alternative Libby Dam operations

Ensure that decisions on contemplated dam operations reflect environmental values

Incorporate public input

- Better impact analysis**
- Necessary**
- Required**
- Available to full spectrum of stakeholders**



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Analysis of Potential Impacts

- Hydro-regulation modeling
 - Full period of record for combinations of flood control and fish flows (primary difference in fish flows are sturgeon flows at Libby)
- Socioeconomic analysis (including recreation)
- Kootenai Flats agricultural impacts
- Hydropower analysis for system
- Levee integrity



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Analysis of Potential Impacts (cont.)

- Resident fish impacts (reservoir and river)
- Cultural resources impacts (erosion, exposure)
- Water quality impacts (esp. TDG)
- Kootenay Lake nutrients
- Lake Roosevelt sediments and contaminants
- Air quality (esp. airborne dust and sediment)



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Public Coordination

Oct. 2002-Jan. 2003: Scoping meetings in Washington, Oregon, Idaho, Montana, British Columbia

Late 2002: Comment period on interim VARQ implementation

April 2003: Mid-point meetings in Creston, British Columbia

Late 2003: Updated hydro-regulation modeling data for Kootenai and Flathead to be distributed to U.S. and Canadian interests

Late 2004: Comment period on EIS w/ public meetings

Ongoing outreach to/from Kootenai Valley Resource Initiative (KVRI) in Idaho

Working to develop better relationships with Canadian and Tribal stakeholders



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Public Coordination

**Comments accepted anytime prior to final
decision on future dam operations**

uceis@usace.army.mil

or

www.usbr.gov/pn/programs/VARQ/index.html



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Other Studies for BiOp

Channel Capacity Study: A study of channel capacity between the dam and Troy, MT, including structural floodplain encroachment, for peak dam discharges recommended by the BiOp (up to 38 kcfs from the dam)

Flood Level Assessment: For the Kootenai Flats area, evaluating flood levels, public safety concerns, and the feasibility of increasing releases above any identified channel capacity constraints



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Other Studies for BiOp (cont.)

Variable December Draft Point: Evaluating use of a new water supply forecast prior to January 1 to allow a higher end-of-December reservoir elevation target in drier years.



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Other Considerations...

Re-Initiation of Consultation on USFWS BiOp for Libby Dam: Re-opens the 2000 BiOp that addresses Kootenai River white sturgeon.

- Will result in a new BiOp by late spring 2004.
- May alter actions to be implemented to recover sturgeon.
- Re-evaluating physical factors and thresholds important for successful sturgeon recruitment



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